

**DOUGLAS COUNTY  
HAZARD IDENTIFICATION AND  
VULNERABILITY ASSESSMENT**



**DOUGLAS COUNTY SHERIFF'S OFFICE  
DEPARTMENT OF EMERGENCY MANAGEMENT**

*MARCH 2004*

**DOUGLAS COUNTY  
HAZARD IDENTIFICATION AND VULNERABILITY ASSESSMENT**

**FOREWARD**

The Douglas County Hazard Identification and Vulnerability Assessment (HIVA) is an assessment of the natural and technological (man-made) hazards that threaten the people, economy, and assets within the county. Assessment is the initial step in the emergency management process that leads to mitigation against, preparedness for, response to, and recovery from hazards. Hazards have the potential of becoming disasters or emergencies that can adversely affect the people, environment, economy, and property of the county.

Hazard identification and assessment allow emergency managers the ability to recognize risk, determine vulnerabilities, predict potential impacts, and develop plans for response and recovery. Information and data used in this report has been accessed from many different local, state, and federal agencies, and scientific organizations. It is important to note that the Douglas County HIVA is a living document and should be reviewed and updated frequently.

**ORGANIZATION**

The Douglas County emergency management organization is established by resolution C.E. 96-144, pursuant to RCW 38.52. The legislative authority of Douglas County shall be ultimately responsible for emergency management functions. The Director of Emergency Management shall be the Sheriff of Douglas County.

The legislative authorities of the cities of East Wenatchee; Rock Island; Mansfield; Bridgeport; and Waterville are responsible for emergency management functions within their respective cities. They are also responsible for coordination of their emergency efforts with Douglas County Emergency Management.

**SCOPE**

Some hazards identified in this plan are not present in Douglas County but occur frequently in neighboring counties, and can have a direct effect on the people, infrastructure, property, and economy of Douglas County.

**GEOGRAPHY**

Douglas County is situated in north central Washington and comprises a total landmass of 1,817 square miles (2.7 percent of the state's total landmass). Douglas County ranks 17th in size among Washington counties and is bounded to the north by Okanogan County and to the west and southwest by Chelan County. This irregular border is delineated by the Columbia River, which separates the county from its neighbors. Grant County bound it to the east and southeast. The greater part of this boundary roughly mirrors Banks Lake—the former path of the Columbia River. The western extension of Douglas County—where the Columbia River fronts it—is one of hills and canyons. It is there that the terrain begins to merge with the foothills of the east slope of the Cascade Mountain Range. This terrain, particularly that around East Wenatchee, is especially conducive to tree fruit production. The central and eastern parts of Douglas County are composed of rolling hills and flat open land. This area is most suitable for wheat and other grains.

Among the county's major tributaries are Douglas Creek, East and West Foster Creek, McCarteney Creek, and Rock Island Creek (not to mention the Columbia River). The county's major lakes are Lake Entiat, Lake Pateros, and Rufus Woods Lake, all of which were formed by backwaters from dams on the county's western border. Grimes Lake and Jameson Lake are two others, both in the county's interior.

Douglas County is geographically diverse with elevations ranging from 600 feet above sea level near the Columbia River to more than 4,000 feet on Badger Mountain. Basalt rock outcrops and glacial erratics can be found in close proximity to fertile farmland. Irrigated orchard lands are located primarily in the lower elevations while dryland farming dominates the upland areas. Forested areas and areas with steppe shrub vegetation provide diverse wildlife habitat in the county.

The State of Washington Office of Financial Management categorizes 80% of the population of Douglas County as white and 17% of the population is identified as being of Spanish origin. In 1999 there were an estimated 2,577 persons per household in Douglas County with a median household income of \$34,146.

County residents enjoy four distinct seasons. Even so, the weather conditions are noticeably different throughout the county due to the geographic diversity. These weather statistics are an example:

	Waterville	East Wenatchee
Average Maximum January Temperature	30.9°	34.4°
Average Minimum January Temperature	15.6°	21.7°
Average Maximum July Temperature	82.1°	87.8°
Average Minimum July Temperature	52.7°	59.9°
Average Annual Precipitation	11.41 inches	8.95 inches
Average Annual Snowfall	43.2 inches	27.9 inches
Source: National Weather Service		

## ECONOMY

The primary industry in Douglas County is agriculture including the raising of crops and associated industries including packaging, warehousing, shipping and processing. Apples, wheat and cattle are the primary crops although there are significant other crop varieties in the county. Approximately 33% of the workforce in Douglas County is employed in agriculture, twice that of retail trade, which is the second highest employment sector. Today, the Douglas County economy, in terms of employment, continues to be based largely on tree fruit production and local and federal government. Silicon metal manufacturing is the largest manufacturing industry in the county.

## **NATURAL HAZARDS**

### **DROUGHT**

#### *Definition*

Drought is a condition of climatic dryness that is severe enough to reduce soil moisture and water and snow levels below the minimum necessary for sustaining plant, animal, and economic systems.

#### *History*

Even in Washington State, droughts are a natural part of the climate cycle. In the last century, there have been a number of drought episodes, including several that have lasted for more than a single season, such as the dry periods between 1928-32 and 1992-94. The last severe drought episode occurred in 1977, when many of the current records for low precipitation, snow pack, and stream flow totals were set. Overall, the 2001 drought turned out to be the second-worst drought year in state-recorded history.

Since 1925, Douglas County has experienced 12 drought seasons that affected crop and livestock yields. The droughts affecting the region have lasted anywhere between 2 months and 2 years.

#### *HIVA*

Nearly all areas of the state are vulnerable to drought, including Douglas County. In every drought, agriculture is adversely impacted, especially in non-irrigated areas such as dry land farms and rangelands. Droughts impact individuals (farm owners, tenants, and farm laborers), the agricultural industry, and other agriculture-related sectors. There is increased danger of forest and wildland fires. Statewide, millions of board feet of timber have been lost. Loss of forests and trees increases erosion causing serious damage to aquatic life, irrigation, and power development by heavy silting of streams, reservoirs, and rivers. Three energy curtailments, during drought periods prior to 1977, caused temporary unemployment.

Droughts are often categorized on their likely impacts. The National Drought Mitigation Center maps shown below identify three categories:

- Agricultural — Crops that rely on natural precipitation are threatened.
- Water supply — Supplies for irrigated agriculture and municipalities are threatened.
- Fire hazard — Threat of wildfires from dry conditions is increased.

Problems with domestic and municipal water supplies are historically corrected by building another reservoir, a larger pipeline, a new well, or some other facility. Short-term measures, such as using large capacity water tankers to supply domestic potable water, have also been used. Low stream flows have created high temperatures, oxygen depletion, disease, and lack of spawning areas for our fish resources.

#### *Drought lowers hydropower capabilities*

Washington relies heavily on hydropower and drought can have a direct affect on capabilities and production of hydroelectric power. The 2001 drought decreased river flows resulting in less electrical generation and tighter power supplies. In past drought years, shortfalls in state energy generation were typically offset by purchasing power generated outside the Northwest, particularly from California.

#### *Drought adds to state agricultural woes*

Roughly 70 percent of Washington crops are produced on irrigated land — about 27 percent of the state's harvested cropland. As seen proceeding the drought of 2001, drought condition can have a huge impact on the state and regional economic base. With stream flows well below half of normal and groundwater levels threatened, there was significantly less water available for irrigation.

#### *Dry weather sparks blazes*

The lack of moisture in soil increases the probability of wildfires. Although Douglas County has limited timber resources, the threat of wildfire is great in neighboring of Chelan and Okanogan counties.

#### *Conclusion*

As a result of droughts, agriculture uses new techniques. Federal and state governments play an active role in developing new water projects and soil conservation programs. Washington State RCW 43.83B.400-430 and Chapter 173-166 WAC pertain to drought relief.

Better forest fire protection techniques decrease total acreage burned. Progress is made in dealing with the impact of droughts through proper management of water resources. Drought information collection assists in the formulation of programs for future water-short years.

Drought forecasting information and mitigation strategies used in Washington State:

- Irrigation prior to forecasted drought
- Advance warning of changes in stream flows
- Measurement of snow pack conditions
- Studies of areas subject to wind erosion
- Loans for purchase of seed for spring planting and fuel for farm equipment
- Limit irrigation and sprinkling
- Study of ground water supplies
- Shut down of logging operators
- Water conservation measures
- Reduce hydroelectric power use
- Voluntary energy conservation programs
- Purchase of out-of-region energy
- Cloud seeding
- Apply for federal drought relief programs
- State drought legislation
- Consider emergency supplemental ground water permits

## **EARTHQUAKES**

#### *Definition*

An earthquake is the shaking and vibration at the surface of the earth resulting from underground movement along a fault plane or from volcanic activity.

#### *History*

Although Washington State has a history of frequent earthquakes, north central Washington has experienced numerous seismic events. More than 1,000 earthquakes are recorded in the state annually. The state experienced at least 20 damaging events in the last 125 years. In fact, the largest earthquake recorded in Washington State occurred along the Columbia River near Chelan on December 14, 1872.

The 1872 earthquake was estimated at 7.5 on the Richter Scale and it was felt from British Columbia, Canada, to Oregon and from the Pacific Ocean to Montana. Because there were few man-made structures in the epicentral area near Lake Chelan, most of the information available is about ground effects, including huge landslides, massive fissures in the ground, and a 9-meter-high geyser. Extensive landslides occurred in the slide-prone areas of the Columbia River. One massive slide, at Ribbon Cliff (between Entiat and Winesap in Chelan County), blocked the Columbia River for several hours. Although the most spectacular landslides occurred in the Chelan-Wenatchee area, landsliding was reported

throughout the Cascades. This incident was one of many earthquakes felt throughout the Douglas County region.

#### *HIVA*

Eastern Washington, including Douglas County, is vulnerable to shallow earthquakes located in the crust of the earth – unlike areas of western Washington which experiences deep earthquakes. Shallow crustal earthquakes occur in the overriding continental plate within 20 miles of the surface. Douglas County rests on the North American Plate, an overriding plate, and is made of continental crust. Seismic activity in north central Washington is caused by crustal stresses and produces shallow depth activity.

Many aftershocks were reported with the 1872 event and are the evidence for its shallow depth since shallow crustal earthquakes often are followed by aftershocks unlike the deeper subducting slab events.

The epicentral region of the 1872 earthquake lies near the boundary of the North Cascades and Columbia Plateau geologic provinces. Regional topography, many decades of geologic mapping, recent regional tectonic synthesis, Global Positioning System (GPS) observations, and recent seismicity all indicate that this area of central Washington is actively deforming. The 1872 earthquake is important in quantifying the seismic hazard in eastern Washington because it is the largest historical earthquake in Washington east of the crest of the Cascade Range.

Great earthquakes of magnitude 8 to 9+ occurred between colliding plates, at the interface of the Juan de Fuca and North American Plates. The recurrence rate for these events is approximately every 550 years but is irregular, with the interval between events ranging from 200 years to 1,100 years.

Earthquakes cause damage by strong ground shaking and by the secondary effects of ground failures, tsunamis, and seiches. The strength of ground shaking (strong motion) generally decreases or attenuates with distance from the earthquake source. Shaking can be much higher when earthquake waves are amplified by bedrock and then pass into softer geologic materials such as unconsolidated sediments. West Seattle and downtown Olympia are examples where amplification has occurred and ground shaking was much stronger than in other areas.

Earthquakes can cause large and disastrous slides, including debris avalanches from volcanoes. Strong shaking can cause cohesive sediments to lose strength. Loss of strength in clay-rich soils can cause landslides and other ground failures. Liquefaction occurs when water-saturated sands, silts or gravels are shaken so violently that the grains lose their points of contact and rearrange themselves, squeezing the water out of the shrinking pores and causing it to flow outward forming sand “boils” or causing lateral spreading of overlying layers. Liquefaction causes loss of bearing strength under structures, triggers slides, and floats low-density structures, such as fuel tanks and pilings.

Seiches are standing waves in an enclosed or partially enclosed body of water similar to sloshing waves in a bathtub and can be caused by strong shaking. Washington has had minor damage from seiches historically.

Earthquake risk is the probable building damage, and number of people that are expected to be hurt or killed if a likely earthquake on a particular fault occurs. Earthquake risk and earthquake hazard are occasionally incorrectly used interchangeably.

#### *Conclusion*

Washington ranks second in the nation after California among states susceptible to earthquake loss according to a Federal Emergency Management Agency (FEMA) study. The study predicts an annualized loss of \$228 million. It is important to protect our economic base. The functionality of our critical facilities and lifelines such as hospitals, fire stations, schools, power, communications, transportation, fuel delivery systems, dams, etc. will be even more vitally important than the immediate dollar losses following a major earthquake. Population and development have grown, and without

mitigation, we expect higher loss due to the greater exposure. This requires a focus on implementing mitigation measures in our communities in all areas of our lives, including home, school, business, and government:

- Examine, evaluate, and enforce building and zoning codes.
- Identify geologically hazardous areas and adopt land use policies.
- Provide public information on actions to take before, during, and after an earthquake.
- Develop and maintain mitigation, preparedness, response, and recovery programs.

## FLOOD

### *Definition*

A flood is an inundation of dry land with water. Types of floods in Washington State are primarily river, surface water, flash, and tidal.

### *History*

Since 1971, every Washington State county has received a Presidential Disaster Declaration for flooding. From 1956 to 1998 there have been 27 Presidential Major Disaster Declarations floods in Washington State, of which six included Douglas County. (See Flood Event table below)

### *HIVA*

Flooding is a natural feature of the climate, topography, and hydrology of Washington State. Flooding results from bodies of water overflowing their banks; structural failure of dams and levees; accumulation of runoff surface water; tsunamis; and erosion of a shoreline. Contributing factors to flood damage are water velocity, debris carried by water, duration of flood conditions, and ability of soil to absorb water. Flooding predominates throughout the winter and early spring due to melting snow, breakaway ice, and rainy weather.

Flooding on rivers east of the Cascades results from periods of heavy rainfall, mild temperatures, and from the spring runoff of mountain snow pack. Douglas County experiences some seasonal flooding in many local creeks, like Douglas Creek near Douglas, and other drainages areas like Pearl Hill, Foster Creek, Rock Island Creek, and Central Ferry canyons.

Eastern Washington is prone to flash flooding. Thunderstorms, steep ravines, alluvial fans, dry or frozen ground, and light vegetation, which tend not to absorb moisture, can cause the flooding. The city of Wenatchee experiences flash flooding because three canyons are located west of the city, the terrain is rocky, and the vegetation is sparse. A thunderstorm with two inches of rain west of the city is devastating.

Areas within the 100-year flood plain are primarily within the Palisades canyon and the base of Pine Canyon. Most of East Wenatchee, from the Odabashian Bridge south to Rock Island, falls within the 500-year flood plain.

Much of the recent development in Washington State occurs in or near flood plains. This development increases the likelihood of flood damages in two ways. First, new developments near a flood plain add structures and people in flood areas. Secondly, new construction alters surface water flows by diverting water to new courses or increases the amount of water that runs off impermeable pavement and roof surfaces. This second effect diverts waters to places previously safe from flooding.

All the homes and citizens that live in them are vulnerable to flood damage. Only about 22 percent of the homes in flood plains are insured against flood losses. Uninsured homeowners face greater financial

liability than they realize. During a typical 30-year mortgage period, a home in a mapped flood plain has about a 26 percent chance of being damaged by a 100-year flood event. The same structure only has about a one-percent chance of being damaged by fire.

Most cities and counties in Washington participate in the National Flood Insurance Program and have developed local ordinances to better regulate and direct development in flood plain areas. These local ordinances regulate planning, construction, operation, maintenance, and improvements - private or public. Ordinances ensure that work is properly planned, constructed, operated, and maintained to avoid adversely influencing the regimen of a stream or body of water or the security of life, health, and property against damage by floodwater.

### *Conclusion*

Many homes, located in flood plains, are vulnerable to flood damage. Adding to this vulnerability is new growth creating pressure to develop marginal land located near flood plains. As development increases, drainage basins are "built-out," and the volume of storm water runoff and the area that it floods will increase. As a result, homes that were once outside mapped flood plains face a threat of flooding. Currently, 35-40 percent of the National Flood Insurance claims come from outside the mapped flood plains. Developments within flood plains should be limited to non-structures such as parks, golf courses, and farms. These facilities have the least potential for damage, but maximize land use.

Floods cause loss of life and damage to structures, crops, land, flood control structures, roads, and utilities.

The public should be made aware of hazardous areas and given information on flood insurance, mitigation, preparedness, response, and recovery. Local jurisdiction emergency management plans should establish warning, evacuation, housing, and other emergency procedures. This should include awareness of potential disease, hazardous material release, or debris that may affect floodwater. The National Weather Service and other federal cooperative agencies have an extensive river and weather monitoring system and provide flood watch and warning information to the public via radio, television, Internet, Teletype, and telephone.

The United States Army Corps of Engineers, under PL 84-99, has the authority to assist public entities in flood fighting and rescue operations and to protect, repair, and restore federally constructed flood control works threatened, damaged, or destroyed by a flood.

### **Douglas County Flood Events and Total Local Costs**

1948 Flood May-June	\$550,000
1957 Flood May 5	\$55,000
1972 Flood June 9	\$1,735,000
1973 Flood Feb 25	\$145,000
1974 Flood Jan 16	\$440,000
1975 Flood August 18	\$1,480,000
1976 Flood Aug 6	\$120,000
1989 Flood March 10	\$2,267,000
1994 Flood Oct 31	\$605,000
1995 Bridgeport Hill Flood	\$500,000
1995 Flood Jan 11	\$355,000
1995 Moses Coulee, Douglas Creek , Palisades	\$972,923
1997 Flood March 18	\$700,000
1998 Flood May 27	\$352,500



1999 Flood Feb 26	\$380,000
Pearl Hill, Central Ferry Flooding	\$502,500
<b>Total Disaster Costs for this Hazard:</b>	<b>\$11,159,923</b>

## LANDSLIDE

### *Definition*

A landslide is the sliding movement of masses of loosened rock and soil down a hillside or slope. Landslide causes depend on rock type, precipitation, seismic shaking, land development and zoning practices, soil composition, moisture, and slope steepness.

### *History*

In 1872, a landslide triggered by an earthquake blocked the flow of the Columbia River north of Wenatchee for several days. Areas historically subject to landslides include the Columbia River Gorge, the banks of Lake Roosevelt, and the Puget Sound coastal bluffs. Irrigation in parts of Eastern Washington has reactivated ancient slides and caused others where none previously existed.

Although Douglas County does not experience many incidents, landslides have been a problem to some areas of the county. Douglas County experienced landslide activity on Badger Mountain road and DeZellum Hill in 1980 and 1993, respectively. Rocks often fall onto Hwy-2 at Pine Canyon after heavy rain or snowmelt, which remains a hazard to motorists and their vehicles. Extensive landslides occurred in the slide-prone areas of the Columbia River. One massive slide, triggered by an earthquake at Ribbon Cliff (between Entiat and Winesap in Chelan County), blocked the Columbia River for several hours. Although the most spectacular landslides occurred in the Chelan-Wenatchee area, landsliding was reported through out the Cascades. Pine Canyon has experienced road closures due to winter avalanche activity followed by rock and debris slides.

### *HIVA*

Landslides range from shallow debris flows to deep-seated slumps. Sinkholes affect roads and utilities. Due to population density and desire of people to have a home with a view, an increasing number of structures are built on top of or below slopes subject to land sliding. Inconsistent slope mapping and land use regulations in landslide areas make the public unaware of the risk associated in building in potentially vulnerable areas. Land is not stable indefinitely. People believe that if a bluff has remained stable for the last 50 years, it will remain so for the next 50 years regardless of the development or maintenance.

Land stability cannot be absolutely predicted with current technology. The best design and construction measures are still vulnerable to slope failure. The amount of protection, usually correlated to cost, is proportional to the level of risk reduction. Debris and vegetation management is integral to prevent landslide damages. Corrective measures help, but still leave the property vulnerable to risk.

These are characteristics that may be indicative of a landside hazard area:

- Bluff retreat caused by sloughing of bluff sediments, resulting in a vertical bluff face with little vegetation.
- Pre-existing landside area.
- Tension or ground cracks along or near the edge of the top of a bluff.

- Structural damage caused by settling and cracking of building foundations and separation of steps from the main structure.
- Toppling, bowed or jack-sawed trees.
- Gullying and surface erosion.
- Mid-slope ground water seepage from a bluff face.

#### *Conclusion*

By studying the effects of landslides in slide-prone areas, we can plan for the future. More needs to be done to educate the public and to prevent development in vulnerable areas. WAC 365-190-080 states that geologically hazardous areas pose a threat to the health and safety of citizens when incompatible development is sited in areas of significant hazard. Some hazards can be mitigated by engineering, design, or construction so that risks are acceptable. When technology cannot reduce the risk to acceptable levels, building in hazardous areas should be avoided.

Ordinances identifying geological hazards are now in place in most cities and counties. Information regarding steep slope hazards is available from local planning and building department. Landslide losses are reduced 95-100 percent where the established ordinances are rigorously applied.

The least expensive and most effective landslide loss reduction measure is by avoidance. The next most economical solution is mitigation using qualified expertise with an investigation report review process. The most costly is repair of landslide damages. The cost of proper mitigation is about one percent of the costs otherwise incurred through losses and litigation.

## **SEVERE STORM**

#### *Definition*

An atmospheric disturbance manifested in strong winds, tornadoes, rain, snow, or other precipitation, and often accompanied by thunder or lightning.

#### *History*

During the 1996-97 winter storms, high snowfall and cold temperatures resulted in significant snow accumulations. The accumulations aggravated by rain, drifting snow, and ice in roof drains caused excessive weight and the collapse of structures. Douglas County sustained over \$780,000 in damage after the January 1997 winter storm.

#### *HIVA*

All areas of Washington State are vulnerable to the severe local storms. The affects are generally transportation problems and loss of utilities. Transportation accidents occur, motorists are stranded, and schools, businesses, and industries close. The affects vary with the intensity of the storm, the level of preparation by local jurisdictions and residents, and the equipment and staff available to perform tasks to lessen the effects of severe local storms.

Most storms move into Washington from the ocean with a southwest to northeast airflow. Maritime air reaching the Olympic Mountains rises upwards and cools. As this airflow reaches higher elevations and cools, there is less ability to hold moisture and rain occurs.

- Windstorms with sustained winds of 50 miles per hour are powerful enough to cause significant damage and occur frequently. Affected areas are primarily located at the openings of long passes through the mountains, at the base of the mountains, and at the edges of large expanses of open water.

- Tornado funnel shaped clouds generally affect areas of three-quarters of a mile wide and 16 miles long. Tornadoes are produced by strong thunderstorms that generate damaging hail, heavy rain, and wind.
- Blizzards and snowstorms accompanied by high wind and drifting snow occur occasionally throughout the state.
- Ice storms occur when rain falls from a warm, moist layer of atmosphere into a below freezing, drier layer near the ground. The rain freezes on contact with the cold ground and exposed surfaces causing damage to trees, utility wires, and structures.
- Hailstorms occur when freezing water in thunderstorm clouds accumulates in layers around an icy core. Hail damages crops, structures, and transportation systems.
- Dust storms occur east of the Cascades. Wind, following dry periods, blows dirt and light debris aloft.
- Extreme heat temperatures during the summer months occur primarily in Eastern Washington. Individuals, pets, livestock, wildlife, and crops are all affected.

#### *Conclusion*

Local jurisdiction plans should reflect warning and notification of the public, prioritization of roads and streets to be cleared, provision of emergency services, mutual aid with other public entities, procedures for requesting state and federal assistance if needed. To prepare for severe local storms, local jurisdictions should provide public information on emergency preparedness and self-help.

Severe Storms		
Date	Storm Type	Description
August 1967	Heat	Spokane had 11 consecutive days with 90 degrees or warmer. The heat wave affected Eastern Washington and Northern Idaho.
November 1981	Wind	High winds in Western and Eastern Washington.
February 7, 1996	Rain and flood	The Washington State Emergency Operations Center (EOC) activated to handle severe floods covering state. These were considered the most destructive and costly in state history and 19 counties were covered under a Presidential disaster declaration. Three people were killed. Total damages were estimated at \$400 million, an estimated 691 homes destroyed and 4,564 damaged. The EOC remained activated through February 23. Federal Disaster Number 1100 was issued for the incident.
January 31, 1997	Rain and flood	The state EOC activated in response to lowland floods in Walla Walla, Asotin, and Columbia Counties. Flood warnings were in effect for Klickitat and Columbia Rivers. The EOC remained activated until February 1. This incident was part of Federal Disaster Number 1159. Total costs in Douglas County were \$780,000.
March 18, 1997	Rain and flood	The state EOC activated in response to widespread flooding throughout Washington State and remained activated until March 26.

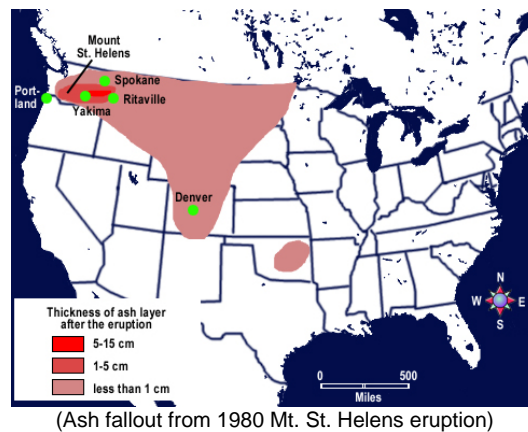
## VOLCANIC ACTIVITY

### Definition

A volcano is a vent in the earth's crust through which magma (molten rock), rock fragments, gases, and ashes are ejected from the earth's interior. A volcanic mountain is created over time by the accumulation of these erupted products on the earth's surface.

### History

On May 18, 1980 at 8:32 a.m., Mount St. Helens erupted killing 57 people. After a 5.1 magnitude earthquake, the volcano's summit slid away in a huge landslide, the largest in earth's recorded history. The landslide depressurized the volcano's magma system, triggering a powerful explosion that ripped through the sliding debris. Rock, ash, volcanic gas, and steam were blasted upwards and outward to the north. The lateral blast produced a column of ash and gas that rose more than 15 miles into the atmosphere in 15 minutes. Damage and cleanup from the volcanic ash fallout cost Douglas County \$40,000. From a second eruption, magma erupted explosively from the newly created crater. Then avalanches of hot ash, pumice, gas, and pyroclastic flows poured out of the crater and spread five miles to the north. Over the course of the day, prevailing winds blew 520 million tons of ash eastward across the United States and caused complete darkness in Spokane.



During the first minutes of the eruption, parts of the blast surged over the new crater rim and down the west, south, and east sides of the volcano. The hot rock and gas melted snow and ice, creating surges of water that eroded and mixed with loose rock and debris to form lahars (mudflows). The lahars poured into river valleys, ripping trees from their roots and destroying roads, bridges, and streambeds. The most destructive lahar was in the North Toutle River and increased in size as it traveled downstream destroying bridges and homes. It reached maximum size in the Cowlitz River at midnight about 50 miles downstream from Mount St. Helens.

### HIVA

Scientists define a volcano as active if it has erupted in historic time or is seismically or geothermally active. By this definition Mount Rainier, Mount Baker, and Mount St. Helens are active volcanoes. Even Glacier Peak has erupted as recently as a thousand years ago and possibly even as late as the 17th century. Mount Adams is also capable of renewed activity.

Volcanoes commonly repeat their past behavior. It is likely that the types, frequencies, and magnitudes of past activity will be repeated in the future. Volcanoes usually exhibit warning signs that can be

detected by instruments or observations before erupting. However, explosions caused by heated material coming into contact with ground water can happen without warning.

In the future, Washington State can expect volcanoes avalanches, lahars (mudflows), lava flows, pyroclastic flows, and tephra falls, and collapse of a sector of a volcano within the Cascade Range. Valleys are vulnerable to lahars, volcanic debris flows, and sedimentation, which can destroy lakes, streams, and structures. Areas downwind of a volcano eruption are vulnerable to reduced visibility, ash fall, and caustic gases. This is the primary hazard Douglas County faces from regional volcanic activity in the northwest.

Ash falls are harsh, acidic, gritty, smelly, and causes lung damage to the young, old, or people suffering from respiratory problems. When atmospheric sulfur dioxide combines with water it forms diluted sulfuric acid that causes burns to skin, eyes, mucous membranes, nose, and throat. Acid rains affect water supplies, strip and burn foliage, strip paint, corrode machinery, and dissolve fabric. Heavy ash falls blots out light. Heavy demand for electric light and air conditioning cause a drain on power supplies. Ash clogs waterways and machinery. It causes electrical short circuits, drifts into roadways, railways, and runways. Very fine ash is harmful to mechanical and electronic equipment. The weight of ash causes structural collapse, particularly when it becomes water saturated. Because it is carried by winds it continues as a hazard to machinery and transportation systems for months after the eruption.

Volcanic earthquakes occur within a volcano. Earthquakes from local tectonic sources or shallow faults in the earth's crust can also shake a volcano. Examples of such earthquakes include the "St. Helens seismic zone" and "West Rainier zone." All Washington State volcanoes are situated close shallow crustal fault zones.

### *Conclusion*

Preparedness and land use planning are important for mitigation of volcanic hazards. Reducing population growth in paths of lahars, implementing warning systems, and planning and practicing evacuations can lower the potential loss of life and property during future eruptions. These actions can reduce the risk from lahars and provide a measure of safety for those living, working, and recreating in valleys surrounding Washington State's volcanic mountains.

The state, federal, and local governments have joined to develop volcanic hazard plans that address issues of emergency response and strategies for expanded public awareness and mitigations. There are plans in existence for Mount St. Helens, Mount Rainier, and Mount Baker and in progress for Glacier Peak.

Volcanic hazard assessments are published by the U.S. Geological Survey for Mount Rainier, Mount Baker, Mount St. Helens, Mount Adams, and Glacier Peak. As part of their comprehensive planning process, local jurisdictions are encouraged to consider debris avalanche, mudflow, and eruption hazards from these volcanoes.

## **TECHNOLOGICAL HAZARDS**

### **HAZARDOUS MATERIALS**

#### *Definition*

Hazardous materials are materials, which, because of their chemical, physical, or biological nature, pose a potential risk to life, health, or property when released. A release may occur by spilling, leaking, emitting toxic vapors, or any other process that enables the material to escape its container,

enter the environment, and create a potential hazard. The hazard can be explosive, flammable, combustible, corrosive, reactive, poisonous, toxic, biological agent, and radioactive.

### *History*

Hazardous chemicals, such as ammonia, chlorine, propane, and others, are heavily used for various agricultural and manufacturing processes at many locations throughout the state. Nearly all chemical hazard incidents in Douglas County have been minor and have involved tampering and theft of anhydrous ammonia.

### *HIVA*

Hazardous materials are used for a variety of purposes and are regularly transported through many areas in Washington State. Ammonia is used as a refrigerant, in agriculture, and in wastewater treatment. Chlorine is used in wastewater treatment, sanitization of drinking water and swimming pools, aluminum manufacturing, and for bleaching paper, wood pulp, and textiles. Propane is widely used as a fuel. Nearly every community has a chemical hazard or a hazardous material transportation system that should be included in public education and emergency planning.

Ammonia is often used for agricultural purposes, for refrigeration, and as a cleaner when dissolved in water. At room temperature it is a colorless, flammable gas with a pungent, suffocating odor. It becomes a clear, colorless liquid under increased pressure. Ammonia is usually shipped as a compressed liquid in steel cylinders. Anhydrous ammonia is the form used primarily in refrigeration and agriculture. Ammonia dissolves in water to form ammonium hydroxide, a corrosive solution. Concentrations of ammonium hydroxide vary from 5 percent to 10 percent for household use and 25 percent or more for industrial use. The sheer volume of ammonia required to meet the needs of users places it on the list of the top ten chemicals produced in the U.S.

Anhydrous ammonia is a critical ingredient in the production of methamphetamine and users dangerously remove the liquid from storage tanks without proper personal safety equipment or storage containers. This is not only a hazard to the person stealing the ammonia, but it is also a hazard to the people and environment near the chemical. Exposure to anhydrous ammonia can cause blindness, lung damage, burns, or death. Stolen ammonia can be unintentionally released, causing injuries to employees, emergency responders, and the criminals themselves.

The Washington State Department of Ecology reported 3,988 confirmed hazardous materials spills in 1999. The continuing increase in responses to clandestine methamphetamine labs is of particular concern. The Department of Ecology conducted 789 drug lab responses in 1999 as compared to 339 in 1998, 173 in 1997, and 153 in 1996. Douglas County Sheriff's Office has identified and closed

Each incident's impact and resulting response depends on a multitude of interrelated variables that range from the quantity and specific characteristic of the material to the conditions of the release and area/population centers involved. Releases may be small and easily handled with local response resources or rise to catastrophic levels with long-term consequences that require representatives of federal, state, and local governments to be present at the scene, with each level consisting of personnel from between five and 15 different agencies.

Washington State has 46 Local Emergency Planning Committees (LEPC), including Chelan/Douglas Counties. These LEPCs, in concert with their respective local emergency management offices, conduct hazard identification, vulnerability analysis, and risk assessment activities for their jurisdictions. Federal and state statutes require LEPCs to develop and maintain emergency response plans based on the volumes and types of substances found in, or transported through, their districts. The Chelan/Douglas County LEPC meets every quarter to identify and discuss the hazardous material hazards and activities in the area.

### *Conclusion*

The state developed and adopted standardized hazardous materials emergency response training. Training and supporting materials are available to all public emergency responders. Several

LEPCs conducted commodity flow studies from 1997 through 1999 with funding from Hazardous Materials Emergency Preparedness Grants. Hazard identification, vulnerability analysis, and risk assessment documentation and databases for hazardous materials incident are maintained by the Washington State Departments of Ecology, Health, Transportation, and the Washington State Patrol.

## **CIVIL DISTURBANCE**

### *Definition*

Any incident that disrupts a community where intervention is required to maintain public safety is a civil disturbance. Examples are demonstrations, riots, strikes, public nuisances, and criminal activities.

### *History*

There are no reports of civil disturbance or unrest in Douglas County, other than minor domestic issues.

### *HIVA*

Generally, the cities with populations of more than 100,000 are vulnerable to civil disturbances. Smaller college towns like Bellingham, Olympia, and Pullman also are subject to civil disturbances. Local and county government offices and courthouses reside in Waterville and East Wenatchee, but have never attracted a civil disturbance or disorder. The presence of professional sports teams can be a catalyst for disruptive behavior. Douglas County does not have the elements are the most likely to fuel and sustain a disturbance.

### *Conclusion*

The potential for civil disturbance exists in the state. There are major population centers with populations in excess of 100,000 and smaller communities with government offices and colleges. Cities with unions, capabilities of hosting world venues, and ethnic groups are likely areas for civil disturbance. Civil disturbances in Washington State are probable.

The Washington State Department of Corrections and local corrections offices usually handle prisoner unrest. In the event of emergency, communities may need to be on alert to protect its citizens.

## **DAM FAILURE**

### *Definition*

Dam failure is the uncontrolled release of impounded water resulting in downstream flooding, which can affect life and property. Flooding, earthquakes, blockages, landslides, lack of maintenance, improper operation, poor construction, vandalism, or terrorism cause dam failures.

### *History*

In recent years, dam failures in the United States have prompted renewed public and government concern and action. Public Law 92-367, the National Dam Inspection Act, resulted in the inventorying of dams in the United States and the inspection of non-federal dams nationally.

### *HIVA*

The Department of Ecology, Dam Safety Office, in its 1998 Report to the Legislature stated that the responsibility for the 1025 dams in Washington State rests with several agencies. Dam safety units within the respective federal agencies inspect the 69 federally owned and operated dams. Private engineering consultants inspect the 76 non-federal hydropower dams licensed by the Federal Energy Regulatory Commission. There are currently 880 dams in Washington State under the sole jurisdiction of the Dam Safety Office.

Of the dams inspected by the Dam Safety Office, 296 are situated above populated areas. Nearly all of the 115 dams located upstream of three or more residences (high downstream hazard potential) have previously been inspected and are supposed to be on a six-year inspection cycle. However, a decrease in dam safety engineering staff in 1997 resulted in fewer inspections than necessary to meet the six-year inspection cycle. There are 181 dams that have a significant downstream hazard potential where one or two homes are at risk in the event of dam failure.

On average, Washington State experiences a dam failure approximately once every two years. According to reports, Douglas County has never experienced a dam failure but the probability exists. The majority of failures result from inadequate maintenance and monitoring of the facilities. Failure of a dam can have many effects such as loss of life and damage to structures, roads, utilities, crops, and the environment. Economic losses also can result from a lowered tax base and lack of power profits.

The Douglas County Public Utilities District (PUD) owns and operates the Wells Hydroelectric Project. Nearly all of the power serving Douglas County is generated at the Wells Hydroelectric project. Wells Dam is unique in its design of combining the powerhouse, spillway, switchyard, and fish facilities in a single structure. Wells Dam is 1165 feet long and contains 10 generating units which can produce 840 megawatts of power. In addition to Wells Dam, four other dams reside along Douglas County's Columbia River shoreline. They include the Grand Coulee Dam, Chief Joseph Dam, Rocky Reach Dam, and Rock Island Dam. The only dam owned and operated by Douglas County PUD is Well Dam.

### *Conclusion*

Periodic inspections are the primary tool for detecting deficiencies at dams that could lead to failure. Experience shows that corrections of these safety deficiencies in a timely manner can prevent dam failure and other serious incidents from occurring. Periodic inspections help identify dams where significant development has occurred downstream, resulting in the need for more stringent building and planning codes due to greater population at risk.

## **HAZARDOUS MATERIALS**

### *Definition*

Hazardous materials are materials, which, because of their chemical, physical, or biological nature, pose a potential risk to life, health, or property when released. A release may occur by spilling, leaking, emitting toxic vapors, or any other process that enables the material to escape its container, enter the environment, and create a potential hazard. The hazard can be explosive, flammable, combustible, corrosive, reactive, poisonous, toxic, biological agent, and radioactive.

### *History*

The Washington State Department of Ecology reported 3,988 confirmed hazardous materials spills in 1999. The continuing increase in responses to clandestine methamphetamine labs is of particular concern. The Department of Ecology conducted 789 drug lab responses in 1999 as compared to 339 in 1998, 173 in 1997, and 153 in 1996. See Table 10 for Spills Report Summary.



### *HIVA*

Hazardous material incidents are intentional and/or unintentional releases of a material that because of their chemical, physical, or biological nature, pose a potential risk to life, health, environment, or property. Each incident's impact and resulting response depends on a multitude of interrelated variables that range from the quantity and specific characteristic of the material to the conditions of the release and area/population centers involved. Releases may be small and easily handled with local response resources or rise to catastrophic levels with long-term consequences that require representatives of federal, state, and local governments to be present at the scene, with each level consisting of personnel from between five and 15 different agencies.

The Washington State Hazardous Materials Program consists of several agencies, each responsible for specific elements of the program. A number of strategies have evolved to limit risk, respond to, and recover from hazardous materials releases, intentional discharges, illegal disposals, or system failures. A comprehensive system of laws, regulations, and resources are in place to provide for technical assistance, environmental compliance, and emergency management.

Washington State has 46 Local Emergency Planning Committees (LEPC). These LEPCs, in concert with their respective local emergency management offices, conduct hazard identification, vulnerability analysis, and risk assessment activities for their jurisdictions. Federal and state statutes require LEPCs to develop and maintain emergency response plans based on the volumes and types of substances found in, or transported through, their districts.

### *Conclusion*

The state developed and adopted standardized hazardous materials emergency response training. Training and supporting materials are available to all public emergency responders. Several LEPCs conducted commodity flow studies from 1997 through 1999 with funding from Hazardous Materials Emergency Preparedness Grants. Hazard identification, vulnerability analysis, and risk assessment documentation and databases for hazardous materials incident are maintained by the Washington State Departments of Ecology, Health, Transportation, and the Washington State Patrol.

## **PIPELINE**

### *Definition*

Pipelines are transportation arteries carrying liquid and gaseous fuels. Pipelines are buried and above ground.

### *History*

Douglas County does not have a recorded incident involving a pipeline accident or emergency.

### *HIVA*

Buried and exposed pipelines are vulnerable to breaks and punctures caused by earth movement, material failure, operator error, construction defects, and tampering. Fuel leaks cause hazardous materials spills, fires, and explosions. Williams Pipeline West (WPW) owns an interstate pipeline with service from Canada, through Sumas, and north from New Mexico. Williams Pipeline West operates a pipeline along the Columbia River south into Wenatchee (Chelan County) and does not enter Douglas County. Cascade Pipeline maintains and operates the pipeline from Wenatchee to Quincy. Again, this line does not enter or cross Douglas County. There are no major active fuel pipelines in Douglas County.

Most pipelines are buried; however, there are exposed areas. When crossing rivers, the lines are either attached to a crossing structure or buried below the flood area. In Kalama, the pipe is under the train trestle. There are two sites on the Columbia River and both are under the riverbed.

Pipelines and right-of-ways are frequently surveyed for land movement. By law, an entire pipeline has 26 fixed wing or rotary wing aerial surveys per year. At least once a year, someone walks the ROW. When indications of potential problems occur, more surveys are conducted, especially following increased rainfall.

If a pipeline moves during land movement, it can shear. When the shear moves across abrasive materials or comes in contact with an ignition source, then sparks can cause the fuel to explode or burn. Monitoring markers are used to denote creeping soil movement for potential strain on the pipe.

### *Conclusion*

Pipeline breaks and punctures are reduced by compliance with safety measures set by the Federal Pipeline Safety Law and following prescribed operations and maintenance procedures. Breaks are reduced by operating with proper pipeline pressure, installing correct thickness and grade of the steel and monitoring its wear, and reducing third party damage from excavators, driving over the lines, and encroachment of pipeline right-of-ways. Disruption of pipeline service impacts our ability to heat homes and businesses and fuel equipment. It can cause the price of fuel to increase.

## **RADIOLOGICAL**

### *Definition*

Radiological hazard is the uncontrolled release of radioactive material that can harm people or damage the environment.

### *History*

In Washington State and Douglas County, there have been no radiological releases affecting local jurisdictions from any nuclear power generating system.

### *HIVA*

Although Douglas County does not have any facility capable of a radiological release, Washington State areas capable of radiological release are the Energy Northwest's Columbia Generating Station nuclear power plant located 14 miles north northwest of Richland, the DOE Hanford Site, military bases, medical and research facilities, private industry, and trucks, trains, aircraft, and vessels transiting the state carrying radiological materials.

Energy Northwest operates the commercial nuclear power plant called Columbia Generating Station near Richland. Effects of an emergency at the plant could range from no radioactive release to a radioactive release that would initiate the evacuation of the general population within an approximate radius of 10 miles of the facility. Sirens, tone alert radios, and local media stations would alert the community. Radioactive materials from a release may enter the human food chain via crops or dairy products out to an approximate radius of 50 miles from the facility. Meteorological conditions can influence the size of the contaminated area.

The Washington State Department of Health licenses nearly 400 facilities in the state that use radioactive materials. These are categorized in three major groups: medical, industrial, and laboratory. Hospitals,

clinics, laboratories, and research facilities routinely use radiation in the diagnosis and treatment of medical and dental patients. Industrial applications include various flow gauges, research and development facilities, and radiography to non-destructive test welds and castings for flaws. Medical, industrial, and research use of radiological materials similarly dictate the need for local emergency planning.

Local communities and facilities need to be aware of potentially hazardous nuclear and radiological activities. Basic local planning is needed to mitigate and respond to potential incidents.

Another aspect that contributes to the hazard is public perception. Even if not exposed to an actual physical threat, many people may panic, believing radiation may have affected them.

### *Conclusion*

While the probability of a catastrophic hazardous material release is small, the consequences from the radiological and chemical hazardous materials are significant. Emergency management programs provide a tested emergency response capability designed to protect the people around hazardous areas.

## **TERRORISM**

### *Definition*

Terrorism is the unlawful use of force or violence against persons or property to intimidate or coerce a government or civilian population, in furtherance of political or social objectives.

### *History*

Of the 25 terrorist incidents reported by the Federal Bureau of Investigation (FBI) from January 1990 through December 1997, four occurred in Washington State. Douglas County has not reported a terrorism incident to date.

### *HIVA*

Washington State is vulnerable to terrorist activity. Terrorism can be state sponsored or the outgrowth of a frustrated, extremist fringe of polarized and/or minority groups of people. Extremists have a different concept of morality than the mainstream society. They see issues in terms of black and white. Terrorists groups include:

- Ethnic, separatists, and political refugees
- Left wing radical organizations
- Right wing racists, anti-authority survivalist groups
- Extremist issue-oriented groups such as animal rights, environmental, religious, anti-abortionists

Communities are vulnerable to terrorist incidents and most have high visibility and vulnerable targets. These critical facilities, sites, systems, and special events in the community are usually located near routes with high transportation access. Examples include:

- Government office buildings, court houses, schools, hospitals, and shopping centers
- Dams, water supplies, power distribution systems
- Military installations
- Railheads, interstate highways, tunnels, airports, ferries, bridges, seaports, pipelines
- Recreational facilities such as sports stadiums, theaters, parks, casinos, concert halls
- Financial institutions and banks

- Sites of historical and symbolic significance
- Scientific research facilities, academic institutions, museums
- Telecommunications, newspapers, radio and television stations
- Chemical, industrial, and petroleum plants; business offices, and convention centers
- Law, fire, emergency medical services and responder facilities, and operations centers
- Special events, parades, religious services, festivals, celebrations
- Planned parenthood facilities and abortion clinics
- Residential properties

Critical facilities, sites, and special events become more appealing during visits by high profile personalities and dignitaries. Terrorists have introduced two new wrinkles, which are of growing concern: targeting first responders with secondary devices and Weapons of Mass Destruction (WMD) hoaxes. Douglas County has recognized several facilities and structures as potential terrorism targets and measures have been taken to protect and strengthen the potential targets. In 2003, an Individual Target Vulnerability Assessment was completed. Hydroelectric dams and facilities along the Columbia River were recognized as the most visible targets but the hazard threat scored low. In the final assessment, the target threat hazard and target population capacities of each target remained low, while potential target access and target visibility scored high.

Terrorists will go to great lengths to ensure an event produces the intended impact, even if it means destroying an entire structure or killing thousands. Commercially available materials agents can be developed into WMD. Science and the Internet have made information relating to WMD technology available to an ever-widening audience, and terrorists and other would-be criminals are using it for WMD experimentation. Experts generally agree that there are five categories of terrorist incidents: biological, chemical, nuclear, incendiary, and explosive.

Emergency personnel responding to a terrorist incident must be protected from the various hazards that a terrorist incident can produce.

1. Mechanical Hazard. Any type of mechanical harm causing trauma (includes gunshot wounds, bomb fragments or shrapnel).
2. Biological Hazards. Disease causing material including-bacteria (e.g., anthrax); rickettsias (e.g., Q fever; viruses (e.g., hemorrhagic fever); and, toxins (e.g., ricin or botulisms).
3. Thermal Hazard. From both extreme heat and cold (e.g., burning liquids or metals like magnesium; cryogenic materials such as liquid oxygen).
4. Chemical Hazard. Toxic or corrosive substances (e.g., acids such as sulfuric or hydrochloric; caustics such as ammonium hydroxide; toxic substances such as nerve agents, pesticides, or other chemical agents).
5. Radiological Hazard. Alpha, beta, and gamma radiation from radiological hazards.
6. Asphyxiation Hazard. Lack of oxygen in the atmosphere due to displacement by heavier than-air vapors or depletion by a chemical reaction such as burning.

Biological agents pose a serious threat because of their accessible nature and the rapid manner in which they spread. These agents are disseminated by the use of aerosols, contaminated food or water supplies, direct skin contact, or injection. Several biological agents can be adapted for use as weapons by terrorists. These agents include anthrax (sometimes found in sheep and cattle), tularemia (rabbit fever), cholera, the plague (sometimes found in prairie dog colonies), and botulism (found in improperly canned food). A biological incident will most likely be first recognized in the hospital emergency room, medical examiners office, or within the public health community long after the terrorist attack. The consequences of such an attack will present communities with an unprecedented requirement to provide mass protective treatment to exposed populations, mass patient care, mass fatality management, and environmental health clean-up procedures and plans.

Chemical agents are compounds with unique chemical properties that can produce lethal or damaging effects in humans, animals, and plants. Chemical agents can exist as solids, liquids, or gases depending on temperature and pressure. Most chemical agents are liquid and can be introduced into an unprotected population relatively easily using aerosol generators, explosive devices, breaking containers, or other forms of covert dissemination. Dispersed as an aerosol, chemical agents have their greatest potential for inflicting mass casualties.

Nuclear threat is the use, threatened use, or threatened detonation of a nuclear bomb or device. At present, there is no known instance in which any non-governmental entity has been able to obtain or produce a nuclear weapon. The most likely scenario is the detonation of a large conventional explosive that incorporates nuclear material or detonation of an explosive in close proximity to nuclear materials in use, storage, or transit. Of concern is the increasing frequency of shipments of radiological materials throughout the world.

Incendiary devices are either mechanical, electrical, or chemical devices used to intentionally initiate combustion and start fires. Their purpose is to set fire to other materials or structures. These devices maybe used singularly or in combination.

Explosive incidents account for 70 percent of all terrorist attacks worldwide. Bombs are terrorist's weapon of choice. The Internet and local libraries provide ample information on the design and construction of explosive devices. The FBI reported that 3,163 bombing incidents occurred in the United States in 1994, 77 percent were due to explosives. Residential properties are the bombers' most common targets.

Cyberterrorism is a relatively new phenomenon used to potentially disrupt our society and exploit our increasing reliance on computers and telecommunication networks. Cyberterrorism threatens the electronic infrastructure supporting the social, health, and economic well being of Washington's citizens. Interlinked computer networks regulate the flow of power, water, financial services, medical care, telecommunication networks, and transportation systems.

### *Conclusions*

Terrorism is a deliberate strategy with persons' objectives obscured by the fact their acts seem random and indiscriminate. Terrorism is discriminate since it has a definite purpose, but indiscriminate in that the terrorist has neither sympathy nor hate for the randomly selected victim. Communities should use the existing processes and methodologies developed for the successful management of other hazards. Usually, the plans and systems developed for other problems can serve as templates for developing a comprehensive counter-terrorism program. Hazardous material emergency response plans and procedures are helpful in this arena. First responders must remember they are targets and that proactive steps need to be taken to protect the crime scene and the evidence.

## TRANSPORTATION

### *Definition*

Transportation systems in Washington State include road, air, rail, and maritime. Use of these systems and supporting transportation vehicles create the opportunity for accidents, emergencies, and disasters. Transportation hazards are natural or human caused.

### *History*

**Road:** In 1996, two highway accidents were major emergencies. These accidents involved multiple car pileups that closed Interstate 5 (I-5) for hours; detoured traffic clogged other roadways, and overwhelmed local emergency response capabilities.

In 1996, one family was evacuated and a six-mile stretch of State Highway 17 near Leahy Junction was closed when approximately 6,000 gallons of gasoline spilled after a tanker truck rolled over on the highway. The northbound truck was hauling two large fuel tanks when it rolled over. The rear tank tipped onto its side, spilling the gasoline.

**Air:** Washington State has not experienced a major air accident, but the likelihood is increasing. A major air accident would almost certainly involve mass casualties. In Douglas County, several private plane crashes have resulted in injury and death, including the crash of a Navy A-6E Intruder that killed two in 1991.

**Rail:** Washington State experienced rail accidents in recent years. There are no reported rail accidents in Douglas County.

**Maritime:** No major maritime accidents have occurred in Douglas County, but several personal watercraft accidents have occurred in the summer months.

### *HIVA*

- **Road:** Privately owned vehicles and buses provide transportation for individuals in Washington State using freeways, highways, and roads. Trucks and trailers carry interstate and intrastate cargo. Douglas County has over 1,650 miles of county roadway. Routes with high commercial traffic include Hwy 2 and Hwy 97-A along the Columbia River, Hwy 28 through East Wenatchee and Rock Island, Hwy 17 between Grand Coulee Dam and Chief Joseph Dam.
- **Air:** A major airline crash will create a mass casualty incident with hundreds of injuries or deaths. Alaska/Horizon Airlines serves Pangborn Airport in East Wenatchee by providing commuter service to Seattle. The aircraft primarily used is Bombardier Q200 Turboprop that seats 37 passengers.
- **Hazardous materials incidents** are created with fuel spills and dangerous cargo, such as chemicals in a crop duster or an airplane carrying fire retardant. The crash of a military aircraft with munitions or classified material requires the support of explosive ordinance disposal or military security. An airplane crash in a remote area of the state creates a search and rescue situation.
- **Rail:** Major rail carriers in Washington State are Burlington Northern and the Union Pacific for freight, and Amtrak for passenger travel. In Douglas County, the active Burlington Northern Santa Fe lines near Rock Island are most commonly used. Approximately 24 freight trains with 7,000 cars and two Amtrak trains pass through each day. The Columbia River and Cascade Railroad owns and maintains a line that runs along the western edge of the county between Wenatchee and Chief Joseph Dam in Bridgeport. The greatest risk associated with freight trains is a spill of hazardous materials. An accident involving an Amtrak train traveling in Washington State could result in a mass casualty incident.

*Conclusion*

Douglas County is vulnerable to all types of transportation emergencies. The two major effects of transportation accidents are human injury and hazardous materials releases. Mass casualty incidents can be difficult because of location. Remote locations have limited resources; make response time slow, and delay treatment of the injured. Heavily populated locations have crowd control problems and slow response time due to congestion. The worst type of accident would involve mass casualties and a hazardous material release. The presence of hazardous materials slows response to the injured for fear of exposing emergency personnel. Mass casualty events quickly overwhelm local emergency personnel, hospitals, and blood banks. Areas typically plan for these events with mutual aid agreements.

The source and location of transportation accidents vary but the response is typically the same. Response is focused on determining the presence of hazardous materials and then assisting the injured.

## DEFINITIONS

**AVALANCHE** - A mass of sliding snow, ice, earth, and rock that grows and collects additional material as it descends.

**CHEMICAL AGENT (LETHAL)** - A chemical substance that is intended for use in military operations to kill, seriously injure, or incapacitate a person through its physiological effects. Excluded from consideration are riot control agents, chemical herbicides, smoke, and flame.

**CHEMICAL HAZARD** - The release of toxic agents into the atmosphere that can harm population, animals, and food supplies.

**CIVIL DISTURBANCE** - Any incident that disrupts a community where intervention is required to maintain public safety.

**DAM FAILURE** - The uncontrolled release of impounded water resulting in downstream flooding, which can affect life and property.

**DISASTER** - An event expected or unexpected, in which a community's available, pertinent resources are expended; or the need for resources exceeds availability; and in which a community undergoes severe danger; incurring losses so that the social or economic structure of the community is disrupted; and the fulfillment of some or all of the community's essential functions are prevented.

**DROUGHT** - A condition of climatic dryness that is severe enough to reduce soil moisture and water and snow levels below the minimum necessary for sustaining plant, animal, and economic systems.

**EARTHQUAKE** - The shaking of the ground caused by an abrupt shift of rock along a fracture in the earth, called a fault.

**EMERGENCY** - An event, expected or unexpected, involving shortages of time and resources; that places life, property, or the environment, in danger; that requires response beyond routine incident response resources.

**EMERGENCY MANAGEMENT or COMPREHENSIVE EMERGENCY MANAGEMENT** - The preparation for and the carrying out of all emergency functions, other than functions for which the military forces are primarily responsible, to mitigate, prepare for, respond to, and recover from emergencies and disasters, and to aid victims suffering from injury or damage, resulting from disasters caused by all hazards, whether natural or technological, and to provide support for search and rescue operations for persons and property in distress.

**EMERGENCY OPERATIONS CENTER (EOC)** - A designated site from which government officials can coordinate emergency operations in support of on-scene responders.

**EMERGENCY PLANNING ZONES (EPZs)** - The areas for which emergency plans are made to assure that prompt and effective action can be taken to protect the public in the event of a radiological or chemical emergency. In Washington State the first zone is the plume exposure emergency planning zone with an approximate radius of ten miles from the nuclear power plant or chemical depot. The second zone is the ingestion exposure EPZ with an approximate radius of 50 miles. Immediate Response Zone (IRZ) and Protective Action Zone (PAZ) are zones associated with nuclear and chemical storage facilities.

**FAULT** - An abrupt shift of rock along a fracture in the earth.



**FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)** - Agency created in 1979 to provide a single point of accountability for all federal activities related to disaster mitigation and emergency preparedness, response, and recovery. Federal Emergency Management Agency manages the President's Disaster Relief Fund and coordinates the disaster assistance activities of all federal agencies in the event of a Presidential Disaster Declaration.

**FLOOD** - An inundation of dry land with water. Types of floods in Washington State are primarily river, surface water, flash, and tidal.

**FOREST FIRE** - The uncontrolled destruction of forested lands by wildfires caused by natural or human-made events. Wildfires occur primarily in undeveloped areas characterized by forest lands.

**HANFORD SITE** - A 560 square mile complex, located north of the city of Richland, Washington, under the direction of the U.S. Department of Energy.

**HAZARDOUS MATERIALS** - Materials, which, because of their chemical, physical, or biological nature, pose a potential risk to life, health, or property when released.

**IMMEDIATE RESPONSE ZONE** – The six-mile area surrounding the chemical surrounding the chemical storage area at the Umatilla Chemical Depot.

**INGESTION EXPOSURE PATHWAY** - When human beings are exposed to radioactive or hazardous materials from a facility through consumption of water and food stuffs, including dairy products. Emergency planning and protective actions are designed in part, to eliminate or reduce to the minimum exposures due to ingestion of contaminated materials in the area surrounding a facility.

**LAHAR** - Hot rock and gas melts snow and ice, creating surges of water that eroded and mixed with loose rock and debris, also known as a mudflow.

**LANDSLIDE** - Landslide is the sliding movement of masses of loosened rock and soil down a hillside or slope.

**LAVA** - Molten rock that flows onto the earth's surface.

**LOCAL EMERGENCY PLANNING COMMITTEE (LEPC)** - The planning body designated by the Superfund Amendments and Reauthorization Act, Title III legislation as the planning body for preparing local hazardous materials plans.

**MAGMA** - Molten material beneath or within the earth's crust from which igneous rock is formed.

**MAJOR DISASTER** - As defined in federal law, is any hurricane, tornado, storm, flood, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, drought, fire, explosion, or other technological or human caused catastrophe in any part of the United States which, in the determination of the President, causes damage of sufficient severity and magnitude to warrant major disaster assistance... in alleviating the damage, loss, hardship, or suffering caused thereby.

**MARINE SAFETY ZONE (MSZ)** – A Chemical Stockpile Emergency Preparedness Program designated 12-mile stretch of the Columbia River.

**MITIGATION** - Actions taken to eliminate or reduce the degree of long-term risk to human life, property, and the environment from natural and technological hazards. Mitigation assumes our communities are exposed to risks whether or not an emergency occurs. Mitigation measures include, but are not limited to, building codes, disaster insurance, hazard information systems, land use management, hazard analysis, land acquisition, monitoring and inspection, public education, research, relocation, risk mapping, safety codes, statutes and ordinances, tax incentives and disincentives, equipment or computer tie downs, and stocking emergency supplies.

**PIPELINES** - Transportation arteries carrying liquid and gaseous fuels.

**PREPAREDNESS** - Actions taken in advance of an emergency to develop operational capabilities and facilitate an effective response in the event an emergency occurs. Preparedness measures include, but are not limited to, continuity of government, emergency alert systems, emergency communications, emergency operations centers, emergency operations plans, emergency public information materials, exercise of plans, mutual aid agreements, resource management, training response personnel, and warning systems.

**PRESIDENTIAL DECLARATION** - Formal declaration by the President that an Emergency or Major Disaster exists based upon the request for such a declaration by the Governor and with the verification of Federal Emergency Management Agency preliminary damage assessments.

**PROTECTIVE ACTION ZONE (PAZ)** – An area from the Immediate Response Zone to 20 miles from the Umatilla Chemical Depot.

**PYROCLASTIC FLOW** - Hot avalanches of lava fragments and gas formed by the collapse of thick lava flows and eruption columns.

**RADIOLOGICAL HAZARD** - The uncontrolled release of radioactive material that can harm people or damage the environment.

## **RECOVERY**

- a. Activity to return vital life support systems to minimum operating standards and long-term activity designed to return life to normal or improved levels, including some form of economic viability. Recovery measures include, but are not limited to, crisis counseling, damage assessment, debris clearance, decontamination, disaster application centers, disaster insurance payments, disaster loans and grants, disaster unemployment assistance, public information, reassessment of emergency plans, reconstruction, temporary housing, and full-scale business resumption.
- b. The extrication, packaging, and transport of the body of a person killed in a search and rescue incident.

**RESPONSE** - Actions taken immediately before, during, or directly after an emergency occurs, to save lives, minimize damage to property and the environment, and enhance the effectiveness of recovery. Response measures include, but are not limited to, emergency plan activation, emergency alert system activation, emergency instructions to the public, emergency medical assistance, staffing the emergency operations center, public official alerting, reception and care, shelter and evacuation, search and rescue, resource mobilization, and warning systems activation.

**SEICHE** - Standing waves in an enclosed or partially enclosed body of water.

**SEVERE STORM** - An atmospheric disturbance manifested in strong winds, tornadoes, rain, snow, or other precipitation, and often accompanied by thunder or lightning.

**SUBDUCTION ZONE** - A convergent boundary between an oceanic plate and a continental plate.

**TEPHRA** - Clastic volcanic material.

**TERRORISM** - The unlawful use of force or violence against persons or property to intimidate or coerce a government or civilian population, in furtherance of political or social objectives.

**TORNADO** - A localized violently destructive windstorm occurring over land and characterized by a long funnel-shaped cloud that extends to the ground.

**TSUNAMI** - A series of traveling ocean waves of long length generated by earthquakes, volcanic eruptions, and landslides occurring below the ocean floor.

**UMATILLA CHEMICAL DEPOT (UMCD)** - A United States Army ordnance storage facility located in northeastern Oregon formerly known as Umatilla Depot Activity (UMDA). The Depot has been operated since 1942 as a storage site for conventional Army ammunition, bombs, artillery shells, and landmines. It is now a storage site for unitary and binary chemical weapons and agents.

**URBAN FIRE** - Urban fire occurs primarily in cities or towns with the potential to rapidly spread to adjoining structures.

**VOLCANO** - A vent in the earth's crust through which molten rock, rock fragments, gases, and ashes are ejected from the earth's interior.

**WILDLAND FIRE** - Uncontrolled destruction of forests, brush, field crops and grasslands caused by nature or humans.

## INFORMATION RESOURCES

Washington Emergency Management Division (EMD)  
Douglas County Transportation and Land Services (TLS)  
Washington Department of Transportation (WADOT); Office of Pipeline Safety  
National Drought Mitigation Center  
Washington State Department of Community, Trade and Economic Development (CTED)  
National Weather Service (NWS)  
Federal Emergency Management Agency (FEMA)  
Douglas County Public Utilities District (PUD)  
Pacific Northwest Seismograph Network  
University of Washington – Earth and Space Sciences  
Washington State Department of Ecology (DOE)  
University of Wisconsin  
Washington State Department of Natural Resources (DNR)  
University of Washington Geophysics Program  
United States Geological Survey (USGS)  
U.S. Department of Agriculture (USDA)  
National Oceanic and Atmospheric Administration (NOAA)  
U.S. Department of Health  
Washington State Patrol  
National Pipeline Management System  
Wenatchee World Newspaper  
Washington State Employment Security Department – Labor Market and Economic Analysis Branch  
National Park Service  
Chelan County Public Utilities District  
Ammonia Process Safety Management  
Center for Disease Control and Prevention (CDC)